

Efficient Parallel Solver for Unsteady Flow Physics in Complex Space Propulsion Geometries, Phase I

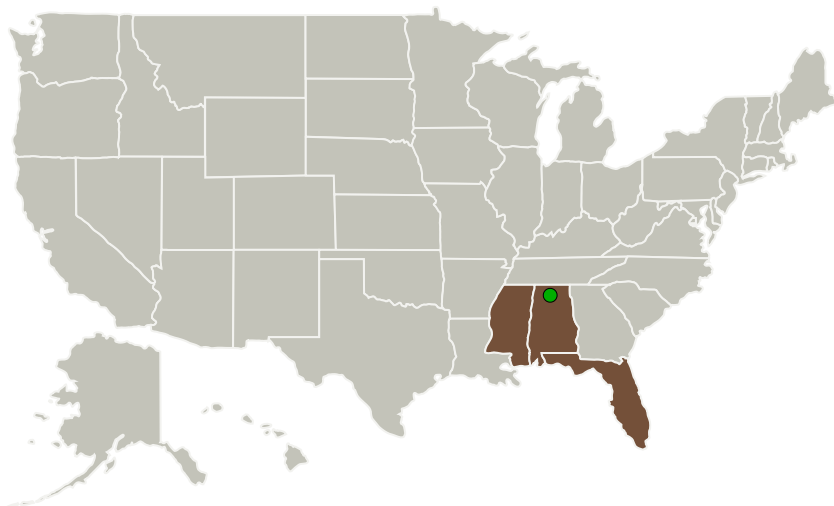
Completed Technology Project (2011 - 2012)



Project Introduction

The innovation proposed here is a framework for the incorporation of high performance, high fidelity computational fluid dynamics (CFD) techniques to enable accurate and robust simulation of unsteady turbulent, reacting or non-reacting flows involving real or ideal fluids with practically useful turnaround times. The emphasis will be on a major improvement in efficiency and scalability of Loci-STREAM which is a CFD code already in use at NASA. The Loci-STREAM code is becoming more and more reliable for individual calculations; however, the overall computational performance of the code on the computer clusters employed by NASA is not sufficient for the tool to be used effectively in the design process given the complexity of the configurations being modeled by NASA engineers along with the large grid sizes used to model these configurations. The proposed work targets an order of magnitude improvement in performance of Loci-STREAM. The work proposed here will enable the efficient and accurate modeling of: (a) multiphase combustion in solid and liquid rocket engines, (b) combustion stability analysis (c) acoustic fields of space propulsion systems in near-ground operation, (d) launch pad-induced environments, (d) small valves and turbopumps, etc.

Primary U.S. Work Locations and Key Partners



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Organizations Performing Work	Role	Type	Location
Streamline Numerics, Inc.	Lead Organization	Industry	Gainesville, Florida
● Marshall Space Flight Center (MSFC)	Supporting Organization	NASA Center	Huntsville, Alabama

Primary U.S. Work Locations	
Alabama	Florida
Mississippi	

Project Transitions

**February 2011:** Project Start**February 2012:** Closed out**Closeout Documentation:**

- Final Summary Chart(<https://techport.nasa.gov/file/138116>)

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Streamline Numerics, Inc.

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

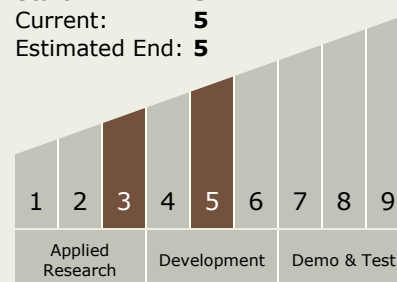
Carlos Torrez

Principal Investigator:

Siddharth S Thakur

Technology Maturity (TRL)

Start: 3
 Current: 5
 Estimated End: 5



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Technology Areas

Primary:

- TX15 Flight Vehicle Systems
 - └ TX15.1 Aerosciences
 - └ TX15.1.7 Computational Fluid Dynamics (CFD) Technologies

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System